ARTICLE XV.

Report of the Committee on the Solar Eclipse of May 14 *and* 15, 1836. *Read July* 19, 1839.

THE committee on Astronomical Observations, to whom were referred several communications relative to the Solar Eclipse of May 14 and 15, 1836, respectfully report:

That the American observations, as far as received, on whose accuracy sufficient reliance may be placed, are the following, and are given in mean time of the places of observation.

No.	Observer.	Place of Observation.	Latitude.	Longitude W. of Greenwich.	Phase.	Mean Time of Observation.
				h. m. s.		*d. h. m. s.*
1	F. R. Hassler	Washington	38° 53′ 12″·7	5 8 7·00	Begin.	14 18 53 58·0
2					End.	21 20 8·0
3	J. Gummere	Haverford	40 1′ 12″·0	5 1 15·00	B	19 3 24·5
4					E	21 31 47·0
5	C. Wistar	Germantown	40 1′ 59″·0	5 0 41·70	B	19 3 55·5
6					E	21 32 49·5
7	I. Lukens	"	"	"	B	19 3 54·5
8					E	21 32 44·5
9	T. M'Euen	Philadelphia	39 56′ 57″·6	5 0 41·33	B	19 3 38·0
10					E	21 32 38·1
11	W. H. C. Riggs	"	"	"	B	19 3 50·0
12					E	21 32 26·5
13	S. C. Walker	"	39 56′ 54″·0	5 0 40·01	B	19 3 40·2
14					E	21 32 43·7

No.	Observer.	Place of Observation.	Latitude.	Longitude W. of Greenwich.	Phase.	Mean Time of Obvation.
				h. m. s.		d. h. m. s.
15	Dr Patterson	Philadelphia	39 56′ 57″·0	5 0 38·88	B	14 19 3 45·8
16					E	21 32 38·3
17	S. Sellers	"	39 57′ 5″·5	5 0 39·05	B	19 3 41·0
18					E	21 32 34·0
19	A. Ferguson	West Hills	40 48′ 49″·2	4 53 44·80	B	19 12 48·5
20					E	21 43 40·0
21	A. Holcomb	Southwick	42 0′ 41″·0	4 51 15·00	B	19 17 52·2
22					E	21 49 20·1
23	R. T. Paine	Providence	41 49′ 39″·3	4 45 39·68	B	19 23 3·2
24					E	21 57 9·0
25	W. C. Bond	Dorchester	42 19′ 15″·0	4 44 17·29	B	19 25 34·5
26					E	21 59 56·6
27	A. Lang.	St Croix	17 44′ 32″·0	4 18 44·00	B	19 3 57·5
28					E	21 44 2·5

The correction of the chronometers, at Philadelphia, was determined by a twenty inch Jones's transit instrument, with high and low stars. The corrections of the deviations of the instrument were computed, and applied. Eastern and western altitudes of the sun were measured by two observers, with different sextants.

This eclipse was more extensively observed in this country than any of the preceding eclipses. Its principal phases had been announced for a great number of places, by a member of this committee, Robert Treat Paine, Esq., in the American Almanac for 1836. Equations for the times of the principal phases, (on the method of Woolhouse,) for places near Philadelphia, by another member of the committee, Mr Sears C. Walker, had been published in the April number of the Journal of the Franklin Institute. Preliminary computations and formulæ for its principal phases for European observatories had appeared in the *Berliner Jahrbuch*, and more particularly in the Nautical Almanac, by Mr Woolhouse. The central and annular path of this eclipse traversed England and Germany. The weather in the United States was unusually fine. In England and Germany the fairness of the weather was such, that few disappointments were experienced by observers situated in its annular path. It was however rainy in Bohemia and Bavaria. In Prussia, Poland and Austria, the weather was generally fine. Northward of Germany the weather was unfavourable. In consequence of the extent of the civilized nations traversed by this eclipse, and of the atmospheric circumstances favourable in the main, it is believed to have furnished a greater number of observations, for geographical and physical purposes, than any other eclipse on record, not excepting the memorable total eclipse of September 7, 1820. The number of spots on the sun's disc was unusually great. The position of these spots, relative to the sun's centre, was carefully determined by Dr Peters, from Schumacher's observations at Altona, on the morning and afternoon of the 15th, with a twelve inch Ertel's equatorial. The times of their contact with, and total obscuration by the moon's limb, were extensively observed, and are placed on record. It does not however appear that any important consequences have yet been derived from this kind of observations. The details of the circumstances of this eclipse are given in full in the 13th and 14th volumes of Schumacher's Astronomische Nachrichten, and in the 10th volume of the Memoirs of the Royal Astronomical Society of London. Among the papers on this subject, the committee would mention, with particular approbation, that of Bessel, No. 320 Astr. Nachr.; of Rumker, No. 319; and of Dr Peters, No. 326; as also Bailey's paper, in the Memoirs of the Royal Astronomical Society, vol. 10, a copy of which (the gift of the author) is placed in the archives of this Society. A reprint of a part of Bailey's paper was exceedingly useful in directing the attention of observers to the remarkable phenomena of the annular eclipse of September 18, 1838. In anticipation of a more full report on the eclipse of 1838, the committee would here remark the fortunate circumstance of the attention of observers being thus directed to these singular appearances; and that the presence in the same building of telescopes of equal optical capacity, furnished with screen glasses of different colours, and their use by the same observer interchangeably, have shown that these remarkable appearances may be modified, if not wholly changed, by the nature of the medium through which they are beheld. The committee indulge a hope that this subject will receive particular attention in future central eclipses, and that the records of the past will be searched into, by those who are possessed of the means, in order to show how far the discrepancies of former observations may be explained by the effect of the screen glass used. In the paper of Professor Bessel, above referred to, are given the analytical formulæ, perhaps the most perfect yet furnished, for the reduction of observations of a solar eclipse for geographical purposes. In Dr Peters's paper, Bessel's method has been applied to the European observations of this eclipse; below will be given the result of an application of the same to the American observations, by Mr Walker. The committee notice, with pleasure, the adoption of these formulæ, in making announcements of solar eclipses, in the *Berliner Jahrbuch* for 1840, by which nearly one half the labour of an isolated computation will be saved. The committee have also to acknowledge, on behalf of the Society, the receipt, through the attentions of Mr A. D. Bache, of a valuable paper on the solar eclipse of the 3d and 4th of March 1840, by Mr C. Rumker, director of the Hamburg observatory. This present was accompanied with a circular, requesting a communication of the American observations of the solar eclipse of May 14, 1836, of which the European ones had been already reduced by that distinguished astronomer, and published in No. 319 of the Astr. Nachr.

A copy of the American observations was furnished to Mr Rumker, through Mr John Vaughan, by a member of this committee. In return for this, the Society has received from Mr Rumker the paper read at their last meeting, which the committee recommend for publication among the documents connected with this eclipse.

It would have been highly acceptable to the committee, had Mr Rumker resolved the equations of condition, which he has obtained, in order to afford to the Society all the advantages which this eclipse is capable of furnishing, for geographical purposes. In the absence of such a result, the committee have appended the computations of Mr Walker, in which the longitudes derived from Rumker's equations of condition are compared with those formerly obtained by Mr Walker, from the same observations, reduced by Bessel's method, using chiefly Peters's co-ordinates and corrections of the tabular elements. The circumstance noticed by Mr Rumker, that the coefficients of the corrections of the moon's latitude and parallax, are affected with opposite signs in the European and American observations, is one of great importance, inasmuch as it facilitates the determination of the latter, and thus affords a rare comparison with the results of meridian altitudes of the moon in *northern*, contrasted with those made in *southern* parallels of terrestrial latitude. The value of $d\varpi$, or the correction of Burckhardt's constant of parallax, as found by Mr Walker, is $+1''\cdot516$. Burckhardt's constant is $57'\ 0''\cdot5$, making, when this correction is applied, $57'\ 2''\cdot0$. It appears from Mr Henderson's memoir on the Constant Quantity of the Moon's Equatorial Horizontal Parallax, (see Memoirs of the Royal Astronomical Society, vol. 10, p. 294,) in which he has discussed an extensive series of meridian observations of 1832 and 1833, with mural circles, at Greenwich, Cambridge and the Cape of Good Hope, that the value of this constant is $57'\ 1''\cdot8$.

It is seldom that solar eclipses have been accurately observed over a portion of the earth's surface large enough to admit of the coefficient of parallax thus changing its sign; occultations of planets and stars of the first magnitude can hardly be expected to furnish equations of condition capable of determining the constant of the moon's parallax with precision. The difficulty of locating observers at convenient places for this purpose, and the uncertainty concerning the precise instant of an immersion or emersion at the moon's bright limb, must continue to furnish obstacles nearly insuperable. The importance, therefore, of Mr Rumker's paper is much enhanced by the rare opportunity which it affords. For the purpose of comparison, the principal values of the moon's horizontal equatorial parallax, yet obtained, are here collected together. They are found chiefly in Mr Henderson's Memoir. They are as follows:

$57'\ 0''\cdot00$	Burg, from Laplace's formulæ, moon's mass $\frac{1}{68\cdot5}$ of the earth's.
$57'\ 1''\cdot00$	Burg, in his lunar tables.
$57'\ 0''\cdot50$	Burckhardt, from Laplace's theory.
$57'\ 0''\cdot90$	Damoiseau, from the same, using for moon's mass $\frac{1}{74}$.
$57'\ 3''\cdot10$	Plana, *Theorie de la Lune*, using for moon's mass $\frac{1}{87}$.
$57'\ 2''\cdot00$	Henderson, from the same, using $9''\cdot25$ for the coefficient of lunar nutation, which gives, for moon's mass, $\frac{1}{79\cdot9}$.
$57'\ 4''\cdot60$	La Caille } From European observations compared with those of La Caille, at the Cape of Good Hope.
$57'\ 3''\cdot70$	Laland }
$57'\ 6''\cdot00$	Du Sejour }

57′ 2″·64	Olufsen, from the same, using compression $\frac{1}{302 \cdot 02}$.
57′ 2″·76	Henderson, from the same, using compression $\frac{1}{300}$.
57′ 1″·80	Henderson, as above mentioned, from meridian observations at the Cape and at Greenwich and Cambridge, in 1832 and 1833. This result depends upon an assumed compression, $\frac{1}{300}$, and gives the moon's mass $\frac{1}{78 \cdot 9}$, and the coefficient of lunar nutation 9″·28.
57′ 0″·43	De Ferrer, from fifteen occultations with meridian observations, and six corresponding occultations.
57′ 2″·00	S. C. Walker, from Rumker's computations of the eclipse of May 14 and 15, 1836, compression $\frac{1}{302 \cdot 78}$.

R. M. PATTERSON,
S. C. WALKER,
R. T. PAINE,
ANDREW TALCOTT, } *Committee.*

Letter of Mr Charles Rumker to Mr John Vaughan, Librarian of the American Philosophical Society at Philadelphia.

Observatory, Hamburg, March 27, 1839.

Sir:

I have to apologize for the delay of the calculation of the valuable American observations of the Solar Eclipse of May 15, 1836, and have now the pleasure of sending you them, together with those of a number of European ones, that have partly been communicated to me since. On account of the opposite parallaxes and latitudes of the moon, her elements might, by a comparison of the American observations with the European ones, be correctly determined. I have used in the calculation, moon's latitude at mean noon at Greenwich, = 19′ 43·″17, N., ☾'s sem. = 14′ 50·″4, ☉'s semidiameter = 15′ 48·″4, which is founded partly upon a comparison of all the observations, partly upon actual measurement of breadth of the ☉'s illuminated disc at the time of the greatest obscuration, and finally, upon a comparison of the calculation at places situate upon the borders of the annulus, with the observations made there.

Your most obedient servant,

CHARLES RUMKER.

P.S. The calculations of the true ecliptic conjunction, as well as of the coefficients of the corrections of semidiameters, ☾'s lat. and par. have been carefully revised, so that I believe this collection of observations to be useful for determining the errors of the lunar elements. Particularly, I think that the annular observations, where the signs of the moon's apparent latitude change, deserve some attention.

The weather was not favourable, at Hamburg, for observing the solar eclipse of March 15, 1839, but at Rostock, in latitude 54° 5′ 45″ N. and longitude 39° 20′ east of Paris, it was observed by Professor Karsten.

B. 4^h 16^m 19^s ·19, mean time	} H. Karsten.
E. 4 54 8 ·69, " "	
E. 4 54 8 ·29, " "	Dr Walter.

America. Mean Time 14th May 1836.						
Place of Observation and Observer.	Latitude, and Longitude + west of Greenwich.	Mean Time of Observation.	Mean Time of Conjunction.	d ☉ + ☾	d Lat. ☾	d Parr.
		h. m. s.	h. m. s.			
Washington, F. R. Hassler.	Lat. 38° 52′ 44″	B. 18 53 58·0	20 58 56·5	+ 2·6845	+ 1·5754	+ 0·2166
	Long. + 5^h 8^m 8^s·6	E. 21 20 8·0	20 58 44·0	− 2·1753	− 0·0438	+ 0·8496
Haverford, John Gummere.	Lat. 40° 1′ 12″	B. 19 3 24·5	21 5 53·9	+ 2·6811	+ 1·5697	+ 0·1731
	Long. 5^h 1m 15^s	E. 21 31 47·0	21 5 41·4	− 2·1753	− 0·0316	+ 0·7576
Germantown, C. Wistar.	Lat. 40° 2′ 40″	B. 19 3 55·5	21 6 25·7	+ 2·6763	+ 1·5578	+ 0·1805
	Lon. a few secs. east of State House, Phil.	E. 21 32 49·5	21 6 23·6	− 2·1751	− 0·0239	+.0·7460
Germantown, Isaiah Lukens.	Lat. 40° 2′ 40″	B. 19 3 54·5	21 6 24·79	+ 2·6764	+ 1·5580	+ 0·1804
	Lon. a few secs. east of State House, Phil.	E. 21 32 44·5	21 6 20·18	− 2·1752	− 0·0245	+ 0·7468
Philadelphia, T. M'Euen.	2^s·8 west State H.	B. 19 3 38·0	21 6 21·5	+ 2·6741	+ 1·5577	+ 0·1848
	Lat. 39° 56′ 59″	E. 21 32 38·1	21 6 22·68	− 2·1751	− 0·0201	+ 0·7472
Philadelphia, W. H. C. Riggs.	2^s·8 west State H.	B. 19 3 50·0	21 6 34·59	+ 2·6725	+ 1·5549	+ 0·1833
	Lat. 39° 56′ 59″	E. 21 32 26·5	21 6 14·21	− 2·1752	− 0·0216	+ 0·7491
Philadelphia, S. C. Walker.	1^s west of State H.	B. 19 3 40·9	21 6 23·82	+ 2·6741	+ 1·5576	+ 0·1850
	Lat. 39° 56′ 54″	E. 21 32 44·1	21 6 28·55	− 2·1752	− 0·0193	+ 0·7463

Place of Observation and Observer.	Latitude and Longitude + west of Greenwich.	Mean Time of Observation.	Mean Time of Conjunction.	d ⊙ + ☾	d Lat. ☾	d Parr.
America—continued.						
		h. m. s.	h. m. s.			
Philadelphia, R. M. Patterson.	$0^s{\cdot}12$ east of St. H.	B. 19 3 45·8	21 6 29·87	+ 2·6732	+ 1·5561	+ 0·1861
	Lat. 39° 56′ 58″	E. 21 32 38·3	21 6 22·58	— 2·1752	— 0·0201	+ 0·7473
Philadelphia, S. Sellers.	In Merid. of St. H.	B. 19 3 41·0	21 6 24·31	+ 2·6740	+ 1·5574	+ 0·1850
	Lat. 39° 57′ 5″	E. 21 32 34·0	21 6 19·34	— 2·1752	— 0·0209	+ 0·7480
West Hills, H. Ferguson.	Lat. 40° 48′ 49″·2	B. 19 12 48·5	21 13 38·8	+ 2·6576	+ 1·5292	+ 0·1674
	Long. 4^h 53^m 45^s	E. 21 43 40·0	21 13 7·5	— 2·1751	— 0·0018	+ 0·6590
Southwick, Mass. A. Holcomb.	Lat. 41° 59′ 0″	B. 19 17 52·2	21 15 57·9	+ 2·6738	+ 1·5572	+ 0·0940
	Long. 4^h 51^m $13^s{\cdot}3$	E. 21 49 20·1	21 15 45·0	— 2·1752	— 0·0222	+ 0·6132
Denmark. Mean Time 15th May.						
Apenrade, Hansen.	Lat. 55° 2′ 57″	B. 2 40 36·8	2 45 14·37	+ 2·1840	+ 0·2005	— 1·2345
		B.A. 4 0 4·8	2 44 52·2	+ 2·2260	+ 0·4730	— 1·6780
	Long. — 37^m 45^s	E.A. 4 4 23·8	2 44 52·8	— 2·1834	— 0·1912	— 1·3315
Copenhagen, Pedersen.	Lat. 55° 40′ 53″	B. 2 55 52·8	2 57 28·93	+ 2·1876	+ 0·2378	— 1·3140
		B.A. 4 15 53·2	2 57 13·8	∝	∝	∝
	Long. — 50^m 20^s	E. 5 59 32·9	2 57 11·0	— 2·1757	— 0·0121	— 1·5950
Tondern, Petersen.		B. 2 37 15·1	2 42 34·9	+ 2·1839	+ 0·2009	— 1·5974
	Lat. 54° 56′ 16″·1	B.A. 3 57 26·88	2 42 34·68	+ 2·1793	+ 0·1357	— 1·4900
	Long. — 4^m $18^s{\cdot}6$	E.A. 4 1 48·1	2 42 34·2	— 2·1797	+ 0·1421	— 1·5065
		E. 5 14 51·12	2 42 31·3	— 2·1775	+ 0·0903	— 1·6404
Germany.						
Altona, Schumacher.	Lat. 53° 32′ 45″	B. 2 43 50·75	2 46 51·02	+ 2·1776	+ 0·1137	— 1·2233
	Long. — 39^m $46^s{\cdot}6$	E. 5 21 23·15	2 46 52·3	— 2·1810	+ 0·1523	— 1·7162
Berlin, Encke.	Lat. 52° 31′ 13″·5	B. 3 2 43·8	3 0 41·3	+ 2·1751	+ 0·0451	— 1·2833
	Long. — 53^m $35^s{\cdot}5$	E. 5 37 31·9	3 0 45·1	— 2·1820	+ 0·1670	— 1·7661
Bern, Treschel.	Lat. 46° 57′ 6″	B. 2 37 8·6	2 37 17·63	+ 2·1962	+ 0·2997	— 1·0900
	Long. — 29^m 46^s	E. 5 16 48·26	2 36 43·36	— 2·2468	+ 0·5608	— 2·1640

Germany—continued.

Place of Observation and Observer.	Latitude and Longitude + west of Greenwich.	Mean Time of Observation.	Mean Time of Conjunction.	*d* ☉ + ☾	*d* Lat. ☾	*d* Parr.
		h. m. s.	h. m. s.			
Bremen, Clüver.	Lat. 53° 4′ 36″	B. 2 38 7·0	2 42 13·38	+ 2·1764	+ 0·0883	— 1·1902
	Long. — 35m 15s·9	E. 5 16 56·9	2 42 14·8	— 2·1850	+ 0·1998	— 1·7406
Bremerhaven, Thulesius.	Lat. 53° 32′ 31″	B. 2 37 27	2 41 58·7	+ 2·1783	+ 0·1264	— 1·6614
	Long. — 34m 19s·6	E. 5 15 27	2 41 24·17	— 2·1821	+ 0·1678	— 1·7163
Brussels, Quetelet.	Lat. 50° 50′ 39″	B. 2 16 0·5	2 24 35·66	+ 2·1750	— 0·0300	— 1·0599
	Long. — 17m 29s	E. 4 59 47·3	2 24 33·9	— 2·2058	+ 0·3635	— 1·8432
Gera, Engelhardt and Metz.	Lat. 50° 32′ 56″	B.				
	Long. — 48m 2s·5	E. 5 33 43	2 55 23·9	— 2·1926	+ 0·2724	— 1·8530
Braunsberg, Feldt.		B. 3 33 40·41	3 26 41·39	+ 2·1807	+ 0·1779	— 1·4430
	Lat. 54° 23′ 9″	B.A. 4 49 23·64	3 26 20·02	+ 3·1550	+ 2·2853	— 2·8270
	Lon. — 1h 19m 17s·94	E.A. 4 52 34·25	3 26 28·16	— 2·9450	— 1·9856	— 0·4588
		E. 6 1 40·11	3 26 20·16	— 2·1756	— 0·0069	— 1·5115
Hamburg, Rumker.	Lat. 53° 33′ 7″	B. 2 44 2·2	2 47 0·54	+ 2·1776	+ 0·1135	— 1·2240
	Long. — 39m 53s	E. 5 21 40·5	2 47 8·89	— 2·1810	+ 0·1526	— 1·7156
Hamburg, Peters.	Lat. 53° 33′ 7″	B. 2 44 7·4	2 47 5·7	+ 2·1776	+ 0·1135	— 1·2240
	Long. — 39m 53s	E. 5 21 30·5	2 46 59·5	— 2·1810	+ 0·1521	— 1·7156
Hanover, Lahmeier.	Lat. 52° 22′ 20″	B. 2 43 49·04	2 46 6·69	+ 2·1750	+ 0·0415	— 1·2012
	Long. — 38m 58s	E. 5 21 48·73	2 45 56·43	— 2·1866	+ 0·2182	— 1·7780
Jena, Schroen.	Lat. 50° 56′ 19″	B.				
	Long. — 46m 15s	E. 5 31 35·0	2 53 28·45	— 2·1932	+ 0·2749	— 1·8501
Koenigsberg, Bessel.	Lat. 54° 42′ 50″	B. 3 36 19·18	3 29 6·63	+ 2·1825	+ 0·1857	— 1·4514
	Long. — 1h 22m 0s·5	E. 6 3 58·66	3 29 3·18	— 2·1759	— 0·0312	— 1·6147
Leipzig, Moebius.	Lat. 51° 20′ 14″	B.				
	Long. — 49m 31s·5	E. 5 34 46	2 56 47·88	— 2·1893	+ 0·2447	— 1·8300
Louvain, Crahay.	Lat. 50° 53′ 26″	B. 2 17 37·3	2 25 47·55	+ 2·1748	— 0·0289	— 1·0588
	Long. — 18m 47s	E. 5 0 52·6	2 25 33·6	— 2·2049	+ 0·3580	— 1·8418

Germany—continued.

Place of Observation and Observer.	Latitude, and Longitude + west of Greenwich.	Mean Time of Observation.	Mean Time of Conjunction.	$d \odot + ☾$	d Lat. ☾	d Parr.
		h. m. s.	h. m. s.			
Manheim, Nicolai.	Lat. 49° 29′ 13″	B.				
	Long. — 33m 50s·8	E. 5 19 21·6	2 40 54·34	— 2·2110	+ 0·3940	— 1·9190
Neumuhlen, Zahrtmann.	Lat. 53° 32′ 42″	B. 2 43 54·4	2 46 54·4	+ 2·1775	+ 0·1128	— 1·2242
	Long. — 39m 42s·1	E. 5 21 20·6	2 46 49·9	— 2·1810	+ 0·1530	— 1·7165
Neustrelitz, Lorentz and Becker.	Lat. 53° 20′ 0″	B. 3 0 28·0	2 59 31·5	+ 2·1764	+ 0·0879	— 1·2840
	Long. — 52m 15s	E. 3 54 58	2 59 17·7	— 2·1799	+ 0·1287	— 1·7238
Rostock, Karsten.	Lat. 54° 5′ 45″	B. 2 54 43·1	2 55 31·8	+ 2·1788	+ 0·1297	— 1·2762
		B.A. 4 14 19·7	2 55 39·6	+ 2·4635	— 1·1568	— 1·6230
	Long. — 48m 41s	E.A. 4 17 58·2	2 55 35·3	— 2·6073	+ 1·4378	— 2·3242
		E. 5 29 58·2	2 55 28·0	— 2·1401	+ 0·0997	— 1·6856
Stettin, Dancke.	Lat. 53° 25′ 8″	B 3 7 51·7	3 5 21	+ 2·1772	+ 0·0997	— 1·3205
	Long. — 58m 16s	E. 5 41 16·3	3 5 21.9	— 2·1782	+ 0·1061	— 1·7150
Stralsund, Steinort.	Lat. 54° 19′ 0″	B. 2 59 44·2	2 59 38.2	+ 2·1803	+ 0·1556	— 1·3025
		B.A. 4 18 7·0	2 59 24·9	+ 2·1891	— 0·2469	— 1·3554
	Long. — 52m 48s	E.A. 4 22 26·6	2 59 28·2	— 2·2254	+ 0·4705	— 1·7530
		E. 5 33 49·2	2 59 25·8	— 2·1785	+ 0·0754	— 1·6694
Strassburg, Herrenschneider.	Lat. 48° 34′ 39″·7	B. 2 36 25·1	2 38 1·37	+ 2·1830	— 0·1911	— 1·1081
	Long. — 31m 0s	E. 5 16 44·9	2 37 48·6	— 2·2232	+ 0·4575	— 1·9562
Vienna, Littrow and Hallaschka.	Lat. 48° 12′ 35″	B.				
	Long. — 1h 5m 31s·9	E. 5 54 37·1	3 12 31·85	— 2·2050	+ 0·3591	— 2·1299
Wurzburg, Schoen.	Lat. 49° 56′ 16″	B. 2 47 4·0	2 46 54·4	+ 2·1773	— 0·1071	— 1·9804
	Long. — 39m 50s	E.				
Zeitz, J.	Lat. 51° 5′ 23″	B.				
	Long. — 48m 12s	E. 5 32 40	2 54 37·6	— 2·1911	+ 0·2602	— 1·8598

Great Britain.

Place of Observation and Observer.	Latitude and Longitude + west of Greenwich.	Mean Time of Observation.	Mean Time of Conjunction.	d ☉ + ☾	d Lat. ☾	d Parr.
		h. m. s.	h. m. s.			
Camden Street, Camden, Shearmann.	Lat. 51° 32′ 26″	B. 1 51 4·67	2 6 52·14	+ 2·1752	+ 0·0435	— 0·9098
	Long. + $35^{\mathrm{s}}\cdot5$	E. 4 38 41·12	2 6 44·38	— 2·2065	+ 0·3680	— 1·7850
Edinburgh, Henderson.	Lat. 55° 57′ 20″	B.A. 2 57 20·77	1 54 11·76	+ 3·0694	+ 2·1662	— 2·3512
		E.A. 3 1 3·22	1 54 23·55	— 2·5243	— 1·2798	— 0·5166
	Long. + $12^{\mathrm{m}}\ 43^{\mathrm{s}}\cdot6$	E. 4 19 21·65	1 54 19·38	— 2·1799	+ 0·1352	— 1·1313
London, Fleet Street, W. Simms, Jun.	Lat. 51° 30′ 50″	B. 1 51 13·0	2 6 59·43	+ 2·1750	+ 0·04298	— 0·9514
	Long. + $25^{\mathrm{s}}.1$	E. 4 38 47·0	2 6 47·2	— 2·2066	+ 0·3685	— 1·6165
Makerstown, Sir T. Brisbane.		B. 1 36 51·2	1 57 17·2	+ 2·1967	+ 0·3111	— 0·9999
	Lat. 55° 34′ 45″	B.A. 3 1 4·2	1 57 19·1	+ 2·2710	+ 0·6532	— 1·5558
	Long. + $10^{\mathrm{m}}\ 4^{\mathrm{s}}$	E.A. 3 5 11·6	1 57 5·5	— 2·1870	— 0·2284	— 1·1635
		E. 4 23 0·6	1 57 4·0	— 2·1809	+ 0·1515	— 1·5579
North Shields, Lieut. Hopkins.	Lat. 55° 2′ 20″	B. 1 43 16	2 1 58·12	+ 2·1903	+ 0·2642	— 1·0070
	Long. + $5^{\mathrm{m}}\ 51^{\mathrm{s}}\cdot13$	E. 4 28 55	2 1 36·50	— 2·1827	+ 0·1759	— 1·5969
Ormskirk, Dawes.	Lat. 53° 34′ 18″	B. 1 34 43·12	1 55 32·28	+ 2·1832	+ 0·1947	— 0·9317
	Long. + $11^{\mathrm{m}}\ 36^{\mathrm{s}}$	E. 4 23 42·02	1 55 38·93	— 2·1924	+ 0·2702	— 1·6614
Shooter's Hill, Simms and Gilby.	Lat. 51° 28′ 0″	B. 1 51 52·1	2 7 26·46	+ 2·1750	+ 0·0402	— 0·9538
	Long. — $14^{\mathrm{s}}.7$	E. 4 39 20·1	2 7 26·7	— 2·2080	+ 0·3670	— 1·7831
Greenwich, Airy.	Lat. 51° 28′ 39″	B.				
	Long. $0^{\mathrm{m}}\ 0^{\mathrm{s}}$	E. 4 39 12·32	2 7 4·62	— 2·2067	+ 0·3693	— 1.7880
Tranby, Cooper.	Lat. 53° 43′ 26″	B. 1 48 5·9	2 5 18·68	+ 2·1831	+ 0·1812	— 0·9926
	Long. + $1^{\mathrm{m}}\ 49^{\mathrm{s}}.4$	E. 4 34 47·35	2 5 18·67	— 2·1891	+ 0·2426	— 1·6726

Poland.

Warsaw, Baronowsky.	Lat. 52° 13′ 5″	B.				
	Long. — $1^{\mathrm{h}}\ 24^{\mathrm{m}}\ 9\cdot7$	E. 6 9 24·6	3 31 5·65	— 2·1773	+ 0·0841	— 1·7456

Spain.

St Fernando, Cadiz, Cerquero, Montojo and Marquer.	Lat. 36° 27′ 43″	B. 1 26 32·53	1 42 29·99	+ 2·3756	— 0·9564	— 0·5994
	Long. — $24^{\mathrm{m}}\ 49^{\mathrm{s}}.1$	E. 4 9 52·0	1 42 13·85	— 2·7473	+ 1·6775	— 2·1818

Note by the Committee.—The latitudes and longitudes of the American places of observation, reported by the committee, are the result of the most recent determinations, and differ, in some instances, from those furnished at an earlier date to Mr Rumker.

Letter of Mr Sears C. Walker.

Philadelphia, July 10, 1839.

To the Committee on Astronomical Observations.

Gentlemen:

Being desirous of deducing the longitudes of the American places of observation from Rumker's expressions for the mean time of conjunction, I have formed thirty-eight equations of condition, from the duration of the eclipse, by subtracting the expression of the conjunction-time derived from the end from that furnished by the beginning, and in a similar manner have obtained seven equations from the observed duration of the ring. Of the last I reject that which is derived from No. 44. I thus find by

			$\Delta(\odot - ☽)$	$\Delta\beta$	$\Delta\pi$
No. (12) — No. (14);	$0 =$	$-1''{\cdot}08$	$+0{\cdot}0504$	$-1{\cdot}3730$	$-0{\cdot}3630$
No. (41) — No. (18);	$0 =$	$-3{\cdot}65$	$-0{\cdot}5063$	$-0{\cdot}8249$	$+0{\cdot}5336$
No. (33) — No. (35);	$0 =$	$+7{\cdot}60$	$+0{\cdot}6563$	$-1{\cdot}8772$	$+0{\cdot}3036$

whence,

$$(a) \ldots\ldots\quad \Delta\beta = 0{\cdot}7044 + 0{\cdot}0492 \times \Delta(\odot - ☽) + 0{\cdot}1163 \times \Delta\pi$$

Substituting this value in the seven equations of condition from the duration of the ring, we have from

$$\begin{array}{llcl}
\text{No. (12);} & \Delta(\odot - ☽)^{(0)} & = & +0''{\cdot}030 + 0{\cdot}0606 \times \Delta\pi \\
\text{No. (14);} & \Delta(\odot - ☽)^{(\mathrm{I})} & = & -0{\cdot}429 - 0{\cdot}0569 \times \Delta\pi \\
\text{No. (33);} & \Delta(\odot - ☽)^{(\mathrm{II})} & = & -0{\cdot}501 + 0{\cdot}0812 \times \Delta\pi \\
\text{No. (18);} & \Delta(\odot - ☽)^{(\mathrm{III})} & = & +0{\cdot}814 + 0{\cdot}2966 \times \Delta\pi \\
\text{No. (35);} & \Delta(\odot - ☽)^{(\mathrm{IV})} & = & +0{\cdot}869 - 0{\cdot}0718 \times \Delta\pi \\
\text{No. (41);} & \Delta(\odot - ☽)^{(\mathrm{V})} & = & +1{\cdot}626 + 0{\cdot}2490 \times \Delta\pi \\
\text{No. (44);} & \Delta(\odot - ☽)^{(\mathrm{VI})} & = & -3{\cdot}161 + 0{\cdot}0644 \times \Delta\pi
\end{array}$$

Rejecting Nos. (41) and (44), which differ most from the mean, and taking the mean of the remaining numbers, there results,

$$(b) \quad \ldots\ldots \qquad \begin{aligned} \Delta(\odot - ☽) &= +\,0''\!\cdot\!1566 + 0\!\cdot\!0619 \times \Delta\pi \\ \Delta\beta &= +\,0\;\cdot\!7121 + 0\!\cdot\!1193 \times \Delta\pi \end{aligned}$$

The sum of the equations Nos. (1) to (11), inclusive, rejecting Nos. (16) and (10) from the United States observations, give (*c*), and the equations from the European observations, rejecting Nos. (17), (18), (20) and (45) give (*d*), as follows:

$$(c) \;..\; 0 = \;\; 50''\!\cdot\!86 + \;\; 43\!\cdot\!6745 \times \Delta(\odot + ☽) + 14\!\cdot\!2733 \times \Delta\beta - \;\; 5\!\cdot\!1156 \times \Delta\pi$$

$$(d) \;..\; 0 = 113\;\cdot\!19 + 101\!\cdot\!1848 \times \Delta(\odot + ☽) - \;\; 5\!\cdot\!1929 \times \Delta\beta + 13\!\cdot\!7391 \times \Delta\pi$$

Equations (*b*), (*c*) and (*d*), give,

$$\begin{aligned} \Delta(\odot + ☽)^{(\text{I})} &= -\,1''\!\cdot\!3972 + 0\!\cdot\!0781 \times \Delta\pi \\ \Delta(\odot + ☽)^{(\text{II})} &= -\,1\;\cdot\!0823 - 0\!\cdot\!1297 \times \Delta\pi \end{aligned}$$

and,

$$\begin{aligned} \Delta(\odot + ☽) &= -\,1''\!\cdot\!279 \\ \Delta(\odot - ☽) &= +\,0\;\cdot\!250 \\ \Delta\beta &= +\,0\;\cdot\!893 \\ \Delta\pi &= +\,1\;\cdot\!516 \end{aligned}$$

But according to Rumker's letter,

$$\begin{aligned} \Delta'(\odot + ☽) &= -\,1''\!\cdot\!000 \\ \Delta'(\odot - ☽) &= -\,2\;\cdot\!000 \\ \Delta'\beta &= -\,7\;\cdot\!630 \\ \Delta'\pi &= \;\;\;0\;\cdot\!000 \end{aligned}$$

whence, denoting by *d* the sum of the corrections respectively denoted by Δ and Δ', we have,

$$\begin{aligned} d(\odot + ☽) &= -\,2''\!\cdot\!279 \\ d(\odot - ☽) &= -\,1\;\cdot\!750 \\ d\beta &= -\,6\;\cdot\!736 \\ d\pi &= +\,1\;\cdot\!516 \end{aligned}$$

which are the most plausible values of the corrections of the tabular elements that I am able to deduce from Rumker's expressions for the conjunction-times. I have given the method of solution somewhat at length, in order that every one may judge whether other modes of combining together the equations of condition might not give more probable results.

With these corrections, and using the longitudes of observatories as given in Rumker's letter, the Greenwich mean time of conjunction is as follows:

		Conjunction-time. h.	m.	s.
By Altona,	Beg.	2	6	59·88
	End,			66·03
By Berlin,	B.			61·11
	E.			69·86
By Brussels,	B.			62·26
	E.			65·26
By Hamburg,	B.			65·58
	E.			71·52
By Hanover,	B.			64·12
	E.			58·73
By Konigsberg,	B.			61·30
	E.			62·99
By Ormskirk,	B.			64·25
	E.			75·46
By St Fernando,	B.			74·29
	E.			64·65
Mean of 16 results,		2	7	5·45

		Conjunction-time. h.	m.	s.
By Copenhagen,	B.	2	7	3·35
By Bremerhafen,	E.			4·91
By Manheim,	E.			3·81
By Edinburgh,	E.			4·18
By Greenwich,	E.			5·06
By Stettin,	B., E.			3·24
By Tranby,	B., E.			6.24
By Neumühlen,	B., E.			7·95
Mean of 8 results,		2	7	4·84
Mean of 24 results,		2	7	5·25

This conjunction-time gives the following longitudes from Greenwich, of the American places of observation; to which I have also appended the results which I have already published in the Journal of the Franklin Institute for August 1838, and which are obtained by using Bessel's method, with Peters's co-ordinates for the end, and mine for the beginning of the eclipse. The corrections of the tabular elements being those obtained by Dr Peters, viz., $\varepsilon = -3''\cdot650$, $\zeta = -5''\cdot472$, $\eta = 0$.

	Walker, from Rumker's Equations. h.	m.	s.	Walker, from Peters's Co-ordinates. h.	m.	s.
Washington Capitol,	5	8	13·83	5	8	13·45
Haverford school, Delaware Co., Pennsylvania,	5	1	16·53	5	1	15·05
Germantown, C. Wistar's private observatory,	5	0	40·61	5	0	40·94
Philadelphia State House,	5	0	38·89	5	0	39·60
West Hills, coast survey,	4	53	41·11	4	53	42·05
Southwick, Mass., A. Holcomb's private observatory,	4	51	12·89	4	51	13·25
Providence, Brown University,	not reduced.			4	45	38·33
Dorchester, Mass., W. C. Bond's private observatory,	"	"		4	44	16·92

Robert Treat Paine, Esq. has informed me that he has found the longitude of Brown University, Providence, $4h$ $45m$ $42\cdot''03$, and that of Dorchester, $4h$ $44m$ $20''\cdot45$, from the observations of this eclipse, at these two places and at Greenwich. In making the computations he has used, $d\lambda = -3''\cdot60$, $d\beta = -7''\cdot63$, $d(\odot + ☽) = -1''\cdot87$. The longitude of Providence from Boston is the same by both computations.

The mean time of the ecliptic conjunction, by the N. Almanac, is $2h$ $7m$ $0''\cdot3$; by observations as above, $2h$ $7m$ $5\cdot25s$; whence, $d\lambda = -2''\cdot276$.

The corrections, $d\lambda$, $d\beta$ and $d\varpi$, from Rumker's equations, may readily be referred to the moon's orbit, and its secondaries, by means of formulæ derived from Airy's Table of Factors (Greenwich observations, 1836), and from Bessel's Theory of ~~Equations~~, as follows: Eclipses.

$$\Delta\alpha = 15 \cdot \frac{S\Delta\lambda + Q\Delta\beta}{PS - QR}$$

$$\Delta\delta = \frac{R\Delta\lambda + P\Delta\beta}{PS - QR}$$

$$\varepsilon = \sin N \cos\delta\,\Delta\alpha + \cos N\,\Delta\delta$$
$$\zeta = -\cos N \cos\delta\,\Delta\alpha + \sin N\,\Delta\delta - \varkappa \cos\pi\,\Delta\pi$$

Where, from Peters's co-ordinates for $3h$ m. t., Berlin, and Airy's factors, we have,

$\varkappa = +0\cdot47147 = L \sin 1'' \operatorname{cosec} \pi$.

$L =$ least distance of centres on true orbit in seconds of arc.

$N = 70^\circ\ 11'\ 10''\cdot4$ = moon's orbital angle.

$\alpha = 52\ 13\ 48''\cdot2$ = moon's true right ascension.

$\delta = +19\ 22\ 40''\cdot3$ = moon's true declination.

$\pi = 54\ 24''\cdot1$ = moon's horizontal equatorial parallax.

$P = +\ 13''\cdot720$

$Q = -\ 0''\cdot244$

$R = +\ 3''\cdot470$

$S = +\ 0''\cdot969$

Whence there results the following comparison:

$$\underbrace{\begin{aligned} \varepsilon &= -2''{\cdot}934, \\ \zeta &= -7\,{\cdot}198, \end{aligned}}_{\text{From Rumker.}} \qquad \underbrace{\begin{aligned} \varepsilon &= -3''{\cdot}650 \\ \zeta &= -5\,{\cdot}472 - 0{\cdot}159 \times \eta' \\ &= -5\,{\cdot}750 \end{aligned}}_{\text{From Peters.}}$$

In which ε is the correction of the moon's tabular place on its orbit, and ζ on a secondary to its orbit.

Respectfully,

SEARS C. WALKER.